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*Indian Standard*  
CODE OF PRACTICE FOR  
ULTRASONIC TESTING OF FERROUS WELDED  
PIPES AND TUBULAR PRODUCTS  
*( First Revision )*

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BUREAU OF INDIAN STANDARDS  
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*Indian Standard*

CODE OF PRACTICE FOR  
ULTRASONIC TESTING OF FERROUS WELDED  
PIPES AND TUBULAR PRODUCTS

*( First Revision )*

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## *Indian Standard*

# CODE OF PRACTICE FOR ULTRASONIC TESTING OF FERROUS WELDED PIPES AND TUBULAR PRODUCTS

( *First Revision* )

## 0. F O R E W O R D

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 5 February 1986, after the draft finalized by the Non-Destructive Testing Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** This standard is intended to be a guide for the ultrasonic testing of ferrous welded pipes and tubular products. This was first published in 1974. This has now been revised in the light of experience gained since its publication.

**0.3** In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960\*.

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## 1. SCOPE

**1.1** This standard covers procedures for detecting longitudinal and transverse ( circumferential ) discontinuities in ferrous welded pipes and tubular products using ultrasonic pulse echo-contact and immersion techniques. It is intended to be used for tubular products having outside diameter greater than 12 mm and having an outside diameter to inside diameter ratios less than 2.

**1.2** For the purpose of this standard, all the relevant requirements specified in this standard in addition to the requirements specified in IS : 3664-1981† are applicable.

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\*Rules for rounding off numerical values (*revised*).

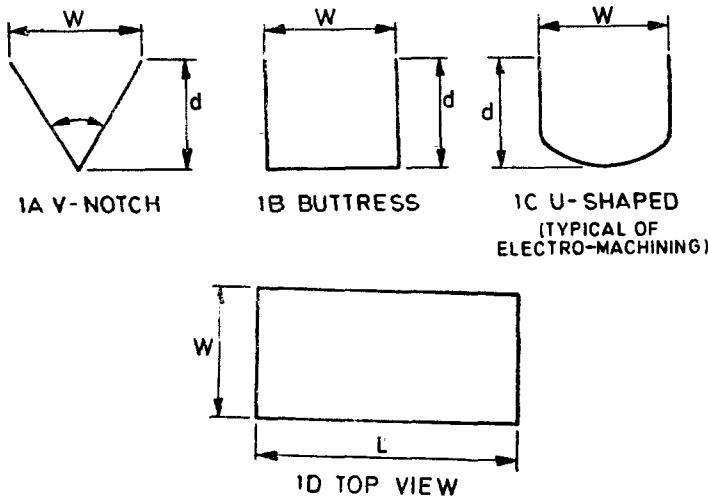
†Code of practice for ultrasonic pulse echo testing by contact and immersion methods (*first revision*).

## 2. REFERENCE STANDARD

**2.1** A reference specimen of a convenient length shall be prepared from a defect free length of the pipe containing the weld. The pipe shall be identical in material and dimensions to the product under inspection. The weld configuration welding procedure and weld surface finish shall be identical to those of the actual welds to be inspected. Reference defects as described in 2.2 shall be introduced in this length of pipe.

**2.2** Longitudinal and transverse notches shall be introduced on the outer (OD) and inner (ID) surfaces of the reference standard. The notches shall be located on the weld. The notches shall be sufficiently separated from each other and from the ends of the tube to avoid mutual interference leading to difficulties in interpretation of reflected signals.

**2.2.1** The acceptable notch configurations and the dimensions to be measured are shown in Fig. 1.



NOTE — In figs. 1A, 1B and 1D the sharp corners are for ease of illustration. It is recognized that in normal machining practice a radius will be generated.

FIG. 1 COMMON NOTCH SHAPES

**2.2.2** The dimensions of the artificial notches shall be as follows:

Length — 12·5 mm, 25 mm or 38 mm or 50 mm as agreed upon by the contracting parties.

Depth — 3 percent, 5 percent, 10 percent or 12 percent of the nominal wall thickness (subject to a minimum of 0·3 mm) as agreed upon by the contracting parties.

However, for critical application the minimum limit can be agreed upon by the contracting parties to 0.2 mm.

**Width** — The width shall be as small as practicable, preferably 1.5 mm or less.

**Angle** — For V-notches, the angle of the notch shall be chosen in relation to the beam angle to be employed during inspection, in order to get maximum reflected signal from the notch.

**Tolerances** — Tolerance on depth shall be  $\pm$  15 percent of the specified depth, subject to a minimum of  $\pm$  0.05 mm.

**2.2.3** The notch depth shall be measured from the circular tubing surface to the deepest penetration of the notch.

### 3. CALIBRATION OF APPARATUS

**3.1** Using the reference standard specified in 2, the equipment shall be adjusted using suitable angle beam probes to produce readily distinguishable and clearly identifiable indications from both OD and ID notches.

### 4. PROCEDURE

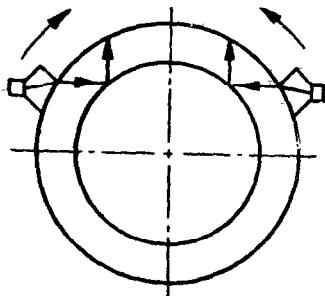
**4.1** During manual operation scanning shall be performed at a minimum gain setting of twice (+ 6dB) the standard level though evaluation of any defect shall be done at the standard sensitivity level. For automated equipment, however, scanning shall be performed at the standard sensitivity level.

**4.2** Scanning shall be carried out in two circumferential directions (see Fig. 2). For critical applications, additional scanning in axial directions, shall be subject of mutual agreement between the purchaser and the supplier. The entire volume of the pipe shall be covered for each scan with a minimum overlap of 15 percent between successive scan path.

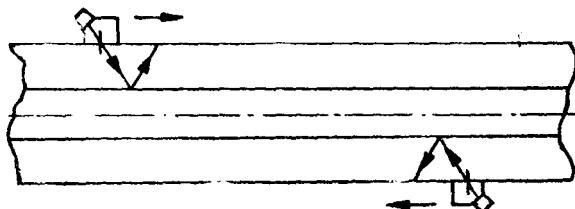
**4.2.1** For circumferential scanning the probe has to move over the weld bead. Therefore, the weld bead has to be ground sufficiently smooth to ensure proper transmission of ultrasonic energy into the weld.

### 5. INTERPRETATION OF RESULTS

**5.1** Indication giving an echo amplitude less than the amplitude of the echo reference notch shall be accepted.



2A Circumferential Scanning in Two Directions



2B Axial ( Longitudinal ) Scanning in Two Directions

FIG. 2 SCANNING DIRECTIONS

**5.2** All indication giving an echo amplitude equal to or greater than the amplitude of the echo from the reference notch shall be considered as suspects and subject to investigation for defects followed by repair. The procedure shall be agreed upon by the contracting parties. After checking the remaining wall thickness, repaired areas shall be retested using the same procedure specified in this standard. Signals lower than the standards shall be considered as acceptable.

**5.3** If automated or immersion scanning technique is used, regions giving indication equal to or greater than the reference echo shall be retested manually to determine their acceptability according to 5.1.

## 6. TEST REPORT

**6.1** All the essential details of the inspection data including results and the date on test set-up required for repeating the test shall be included in the report.

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